

We claim:

1. A composition comprising a porous first material impregnated with a second material, said first material selected from the group consisting of metal oxides and metal hydroxides, and said second material selected from the group consisting of metals, metal cations, and metal oxides.

2. The composition of claim 1, said first material selected from the group consisting of MgO, CeO₂, AgO, SrO, BaO, CaO, TiO₂, ZrO₂, FeO, V₂O₃, V₂O₅, Mn₂O₃, Fe₂O₃, NiO, CuO, Al₂O₃, ZnO, SiO₂, Ag₂O, and combinations thereof.

3. The composition of claim 1, said second material being a soft Lewis acid.

4. The composition of claim 1, said second material selected from the group consisting of Ag, Hg, Au, Ni, Co, Cu, Sn, Ga, In, and Pt and cations and oxides thereof.

5. The composition of claim 1, said first material having a pore volume of at least about 0.3 cm³/g and an average pore opening size of at least about 4 nm.

6. The composition of claim 5, said pore volume being at least about 0.8 cm³/g and said pore opening size being at least 8 nm.

7. The composition of claim 1, said first material having a surface area of at least about 100 m²/g.

8. A composite comprising a plurality of agglomerated nanocrystalline particles including a porous first material impregnated with a second material, said first material selected from the group consisting of metal oxides and metal hydroxides, and said second material selected from the group consisting of metals, metal cations, and metal oxides.

9. The composite of claim 8, said first material selected from the group consisting of MgO, CeO₂, AgO, SrO, BaO, CaO, TiO₂, ZrO₂, FeO, V₂O₃, V₂O₅, Mn₂O₃, Fe₂O₃, NiO, CuO, Al₂O₃, ZnO, SiO₂, Ag₂O, and combinations thereof.

5 10. The composite of claim 8, said second material being a soft Lewis acid.

11. The composite of claim 8, said second material selected from the group consisting of Ag, Hg, Au, Ni, Co, Cu, Sn, Ga, In, and Pt and cations and oxides thereof.

10 12. The composite of claim 8, said first material having a pore volume of at least about 0.3 cm³/g and an average pore opening size of at least about 4 nm.

13. The composite of claim 12, said pore volume being at least about 0.8 cm³/g and said pore opening size being at least 8 nm.

15 14. The composite of claim 8, said first material having a surface area of at least about 100 m²/g.

20 15. The composite of claim 8, said composite retaining at least about 25% of the total pore volume of said first material prior to agglomeration thereof.

16. The composite of claim 8, said composite being in the form of extruded pellets.

25 17. A composition comprising a member selected from the group consisting of Ga₂O₃, In₂O₃, SnO, Ga₂O₃•Al₂O₃, Ga₂O₃•In₂O₃, and In₂O₃•Al₂O₃ and having an average particle size between about 3-30 nm.

30 18. The composition of claim 17, said composition having a surface area between about 30-700 m²/g.

19. The composition of claim 17, said composition having a pore volume of at least about 0.2 cm³/g and an average pore opening size of at least about 4 nm.

5 20. A composite comprising a plurality of agglomerated nanocrystalline particles selected from the group consisting of Ga₂O₃, In₂O₃, and mixtures thereof, said composite retaining at least about 25% of the total pore volume of said particles prior to agglomeration thereof.

10 21. The composite of claim 20, said particles having a surface area between about 30-700 m²/g.

22. The composite of claim 20, said particles having a pore volume of at least about 0.2 cm³/g and an average pore opening size of at least about 4 nm.

15 23. The composite of claim 20, said composite being in the form of extruded pellets.

24. A method of sorbing sulfur compounds from a fluid comprising the steps of:

providing a sorbent material comprising a member selected from the group consisting of-

(a) a composition including a porous first material impregnated with a second material, said first material selected from the group consisting of metal oxides and metal hydroxides, and said second material selected from the group consisting of metals, metal cations, and metal oxides,

(b) a composition selected from the group consisting of Ga_2O_3 , In_2O_3 , SnO , $\text{Ga}_2\text{O}_3 \cdot \text{Al}_2\text{O}_3$, $\text{Ga}_2\text{O}_3 \cdot \text{In}_2\text{O}_3$, and $\text{In}_2\text{O}_3 \cdot \text{Al}_2\text{O}_3$ and having an average particle size between about 3-30 nm.,

(c) a composite comprising a metal oxide nanoparticle at least partially coated with or intimately intermingled with carbon, and

(d) mixtures of (a)-(c); and

contacting the fluid with said sorbent material for sorption of at least a portion of the sulfur compounds therein.

25. The method of claim 24, wherein said sorbent material is in the form of pellets of agglomerated particles of (a), (b), (c), or (d).

26. The method of claim 24, said porous first material selected from the group consisting of MgO , CeO_2 , AgO , SrO , BaO , CaO , TiO_2 , ZrO_2 , FeO , V_2O_3 , V_2O_5 , Mn_2O_3 , Fe_2O_3 , NiO , CuO , Al_2O_3 , ZnO , SiO_2 , Ag_2O , and combinations thereof.

27. The method of claim 24, said second material being a soft Lewis acid.

28. The method of claim 27, said second material selected from the group consisting of Ag , Hg , Au , Ni , Co , Cu , Sn , Ga , In , and Pt and cations and oxides thereof.

29. The method of claim 24, said porous first material having a surface area of at least about $100 \text{ m}^2/\text{g}$.

30. The method of claim 24, said porous first material having a pore volume of at least about $0.3 \text{ cm}^3/\text{g}$ and an average pore opening size of at least about 4 nm.

31. The method of claim 30, said pore volume being at least about $0.8 \text{ cm}^3/\text{g}$ and said pore opening size being at least 8 nm.

32. The method of claim 24, wherein said sorbent material is selected (b) and has a surface area of at least about $100 \text{ m}^2/\text{g}$.

33. The method of claim 24, wherein said sorbent material is selected from (b) and has a pore volume of at least about $0.2 \text{ cm}^3/\text{g}$ and an average pore opening size of at least about 4 nm.

34. The method of claim 24, said carbon coated composite comprising a metal oxide selected from the group consisting of MgO , CeO_2 , AgO , SrO , BaO , CaO , TiO_2 , ZrO_2 , FeO , V_2O_3 , V_2O_5 , Mn_2O_3 , Fe_2O_3 , NiO , CuO , Al_2O_3 , ZnO , SiO_2 , Ag_2O , and combinations thereof.

35. The method of claim 24, wherein said sorbent material is selected from (c), said metal oxide thereof having a surface area of from about $30\text{-}700 \text{ m}^2/\text{g}$.

36. The method of claim 24, wherein said sorbent material is selected from (c), said metal oxide thereof having a pore volume of at least about $0.2\text{-}1.0 \text{ cm}^3/\text{g}$ and an average pore opening of at least about 4 nm.

37. The method of claim 24, said sulfur compound selected from the group consisting of H_2S , SO_2 , and organosulfur compounds.

38. The method of claim 37, said organosulfur compounds being selected from the group consisting of substituted and unsubstituted, saturated and unsaturated aliphatic, cyclic and aromatic organosulfur compounds.

39. The method of claim 38, said organosulfur compound selected from the group consisting of thiophene, dibenzothiophene, dimethyldibenzylthiophene, octanethiol and combinations thereof.

5 40. The method of claim 24, said fluid comprising a hydrocarbon fluid.

41. The method of claim 40, said fluid comprising a member selected from the group consisting of gasoline and diesel fuel.

10 42. In a fuel filter assembly, the improvement comprising a quantity of a composite comprising a plurality of agglomerated nanocrystalline particles selected from the group consisting of:

(a) a composition including a porous first material impregnated with a second material, said first material selected from the group consisting of metal oxides and metal hydroxides, and said second material selected from the group consisting of metals, metal cations, and metal oxides,

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(b) a composition selected from the group consisting of Ga_2O_3 , In_2O_3 , SnO , $\text{Ga}_2\text{O}_3 \cdot \text{Al}_2\text{O}_3$, $\text{Ga}_2\text{O}_3 \cdot \text{In}_2\text{O}_3$, and $\text{In}_2\text{O}_3 \cdot \text{Al}_2\text{O}_3$ and having an average particle size between about 3-30 nm. ,

20 (c) a composite comprising a metal oxide nanoparticle at least partially coated with or intimately intermingled with carbon, and

(d) mixtures of (a)-(c);

said composite being located within said assembly for directly contacting fuel being passed through said filter.

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